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Position at birth as an important factor for the occurrence of anal sphincter tears: a retrospective cohort study

Abstract

Objective: This work aimed to analyze the association between maternal position at birth in spontaneous deliveries and the occurrence of anal sphincter tears (AST) given the lack of evidence related to the least traumatic birth position.

Study design: A total of 7832 vaginal deliveries were included. Vaginal-operative deliveries and deliveries with fundal pressure were excluded. Birth positions on bed, in water, kneeling, and in a squatting position on a low stool were compared. Birth position on bed was considered as the reference group, and a logistic regression analysis adjusting for important fetomaternal parameters was performed.

Results: The overall incidence of AST was 1.1%. AST rate was significantly increased in squatting (2.9%) and kneeling (2.1%) positions compared with birth position on bed (1.0%) or in water (0.9%). Logistic regression analysis revealed a significantly higher risk for ASTs in squatting (OR 2.92, CI 95% 1.04–8.18) and in kneeling positions (OR 2.14, CI 95% 1.05–4.37) compared with the reference group on bed. When adjusting for risk factors, birth in a kneeling position remained significantly associated with ASTs (adj. OR 2.21, CI 95% 1.07–4.54).

Conclusions: Birth in squatting or in kneeling position is associated with an elevated risk for ASTs. Birth in water is not associated with an increased risk for AST. Based on the results, women should be informed about the association of certain birth positions with the occurrence of AST.

Keywords: Anal sphincter tear; AST; birth position; kneeling; perineal tear; squatting.

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Introduction

High-grade perineal trauma is an important and serious complication at vaginal delivery. It is defined as a tear of the anal sphincter complex (third degree anal sphincter tear) or the mucosa of the rectum and/or anal epithelium (fourth degree anal sphincter tear), both are referred to as anal sphincter tears (ASTs) [6]. The incidence of reported AST in vaginal deliveries varies from 1.9% to 11% [3–6, 15, 18].

The consequences for affected young women are indisputable and severe. There is an established association between sphincter muscle damage and anal incontinence reaching up to 53% 5 years after delivery [14]. Furthermore, these defects have significant effects on emotional health, such as anxiety and depression [6]. In fact, these complications pose significant costs to the health care system [17]. Considering that endoanal ultrasound reveals poor results of primary AST repair [2, 16], the importance of avoiding ASTs during vaginal delivery is even more imminent.

Several risk factors for high-grade perineal traumas during birth, such as primiparity [7, 18], the use of forceps [3, 8, 12] or vacuum [17], fundal pressure [18], increased birth weight [3, 12, 18], occipitoposterior position during delivery [7, 17], prolonged second stage [1, 17], midline episiotomies [3, 18] and postmaturity [18] have been described. However, there is limited information about the influence of maternal position at birth on perineal damage. The majority of women in Western societies deliver in bed [11], until some years ago, most likely in a supine position. During the last 20–30 years, certain birth positions have been increasingly suggested as being more natural and pleasant for the parturient woman. While many risk factors for ASTs cannot be influenced, the position at birth can be freely chosen. Therefore, we analyzed

birth positions on bed, in water, in a kneeling position and in a squatting position on a low stool in a unicenter population.

Materials and methods

A retrospective cohort study was conducted to obtain data from our electronic database, Perinat, which contains all diagnoses and clinical data about the course of pregnancy, delivery, and maternal and infant outcomes. The study obtained ethical approval according to the Institutional Review Board's decision for the use of anonymized patient data for medical research (April 13th 2000 and March 1st 2012), based on the World Medical Association Declaration of Helsinki. All deliveries between November 2004 and August 2011 were analyzed. A total of 7832 deliveries fulfilled the inclusion criteria (≥34 weeks of gestation, singleton pregnancy, vaginal delivery, cephalic presentation). Of these, 2015 (25.7%) were successively excluded from the analysis due to vaginal-operative deliveries [vacuum and forceps (n=1369, 17.5%), pressure on the uterine fundus (n=556, 7.1%), and incomplete documentation or unplanned childbirth at home with subsequent treatment at our hospital (n=90, 1.1%)]. The remaining 5817 vaginal deliveries met the inclusion criteria and were included in the study analysis.

Each delivery was led by a staff midwife and supervised by the attending physician. This is the routine setting for deliveries in our hospital. Support of the perineum during delivery has been obligatory. In case of complications or suspected AST, a senior physician was called to define the type of perineal injury.

Information on the following obstetric parameters was collected: maternal age, parity, gestational age at delivery, maternal position at delivery, performance of episiotomy (mediolateral, midline), delivery-related perineal trauma, infant birth weight, infant head circumference, occurrence of shoulder dystocia, and fetal occipitoposterior position.

Position on bed was defined as the woman lying on bed with the trunk elevated at about 45–60 degrees or in a lateral-recumbent position. Lithotomy position on bed was excluded as it represented an established risk factor for AST [10]. In our institution, this position is only used in case of complicated deliveries, such as vaginal-operative deliveries, thus representing a bias. Delivery in a kneeling position was usually performed on the bed, leaning forward on the palms or the elevated end of the birth bed. Delivery in a squatting position was performed on a small and low U-shaped stool (Maya stool).

Third degree perineal trauma was defined as a tear involving the anal sphincter complex and fourth degree perineal trauma as a tear of the mucosa of the rectum and/or anal epithelium, exposing the lumen of the rectum. Both are referred to as high-grade perineal tears or ASTs.

Statistical analysis was conducted using STATA 12.0 (Stata Corporation College Station, TX, USA). The level of statistical significance was set at $P<0.05$. Baseline characteristics were compared using χ^2- and Mann-Whitney test. Prevalence of AST was calculated as proportions of women with AST among all women within a certain group. Risk factors for AST were analyzed, and the characteristics of women with AST were compared to women without AST in the same birth position. Unadjusted odds ratios with 95% CI for the occurrence of an AST were calculated for maternal parameters (birth position, age, parity) and infant factors (gestational age, birth weight, infant's head circumference). A logistic regression analysis adjusting for these factors was conducted for the occurrence of AST in different birth positions. Birth position on bed was defined as the reference group, because most women gave birth on bed and according to our study design. Our aim was to examine the effect of different birth positions on the occurrence of ASTs.

Results

Birth position on bed, in a kneeling position, in water, and in a squatting position were observed in 5031 (86.5%), 420 (7.2%), 228 (3.9%) and 138 (2.4%) cases, respectively (Table 1).

Median maternal age was 30.4 years. Women who gave birth on bed were slightly younger (median: 30.2 years) compared with women in a squatting position (median 31.8), in a kneeling position (median: 31.3), or in water (median: 32.4). Multiparity was significantly more present in the group who gave birth in a kneeling position (68.1%) and less present in those who gave birth in a squatting position (42.0%) compared with

Table 1 Maternal, infant and delivery characteristics in different birth positions and rate of ASTs.

	Bed	Squatting	Kneeling	Water	Total
n	5031	138	429	228	5817
Maternal age (year)	30.2 (14.3–46.9)	31.8[b] (19.6–42.4)	31.3[b] (17.7–44.4)	32.4[b] (19.0–42.6)	30.4 (14.3–46.9)
Multiparous (%)	58.8	42.0[a]	68.1[a]	61.0	59.2
Gestational age (d)	278 (238–303)	278 (245–294)	278 (247–293)	279[b] (250–293)	278 (238–303)
Birth weight (g)	3370 (1230–5140)	3410 (2110–4530)	3430[b] (1920–4630)	3420 (2570–4430)	3380 (1230–5140)
Head circumference (cm)	34.5 (27–40.5)	34.5 (30–37.5)	34.5 (30.5–38)	34.5 (31.5–38)	34.5 (27–40.5)
AST [n (%)]	51 (1.0%)	4 (2.9%)[a]	9 (2.1%)[a]	2 (0.9%)	66 (1.1%)
Episiotomy [n (%)]	1192 (23.7%)	15 (10.9%)[a]	24 (5.7%)[a]	9 (4.0%)[a]	1240 (21.3%)

[a]$P<0.05$, χ^2 test; [b]$P<0.05$, Mann-Whitney test. Data are expressed as median (minimum-maximum), n (%) or % as indicated.
AST=Anal sphincter tear.

the reference group on bed (58.8%) (P<0.05 for both). Infant birthweight was significantly higher in the kneeling group (median: 3430 g) as compared with the reference group on bed (median: 3370 g). Meanwhile, groups in water (median: 3420 g) and in a squatting position (median: 3410 g) were not significantly different. Infant head circumference was comparable in all groups (median: 34.5 cm).

The incidence of ASTs was 1.1%. Analyzing each group of birth position separately, ASTs were found in 1.0% and 0.9% of women who gave birth on bed and in water, respectively. In contrast, ASTs were significantly more present in those who gave birth while in a squatting (2.9%) and kneeling positions (2.1%) (P<0.05 for both) (Table 1).

Episiotomy was performed in 21.3% of deliveries (n=1240). Compared with the reference group on bed, significantly less episiotomies were performed in the three other birth positions (P<0.05 for three groups). The rate of episiotomy in the group of all women with AST (n=66) was 15.2% vs. 21.4% in controls (n=5751) (not significant, P=0.22; data not shown).

In the next step, the characteristics of women with AST were compared to their specific controls within each birth position (Table 2). Baseline characteristics of each study and control group were quite comparable. Solely in the sub-group of women who gave birth on bed and suffered an AST, there were significantly less multipara women (37.3%) compared with the controls (59.1% multiparas).

Logistic regression analysis revealed a significantly higher risk for AST in a squatting position (OR 2.92, CI 95% 1.04–8.18) and in a kneeling position (OR 2.14, CI 95% 1.05–4.37) compared with the reference group on bed (Table 3). AST risk for birth in water was not significantly different (OR 0.86, CI 95% 0.21–3.57). When adjusting for maternal age, parity, birth weight, head circumference and gestational age in a multivariate logistic regression analysis, birth in a kneeling position remained significantly associated with ASTs (adj. OR 2.21, CI 95% 1.07–4.54) while the increased rate of ASTs associated with birth in a squatting position just missed the level of statistical significance (adj. OR 2.67, CI 95% 0.95–7.53). The risk of AST in water remained without difference to birth on bed (adj. OR 0.83, CI 95% 0.20–3.43). Known risk factors for AST, such as infant weight at birth (over 3500 g: adj. OR 2.89, CI 95% 1.69–4.95) and primiparity (multipara women: adj. OR 0.39, CI 95% 0.23–0.65) could be confirmed. Maternal age, gestational age at delivery, and infant head circumference were not associated with statistically significant elevated risks (Table 3).

Table 2 Maternal and infant characteristics of women with and without AST within each birth position.

	Bed		Squatting		Kneeling		Water	
	AST	No AST	AST	No AST	AST	No AST	AST	No AST
n	51	4980	4	134	9	411	2	226
Maternal age (year)	30.8 (16.9–39.7)	30.2 (14.3–46.9)	34.9 (29.4–38.0)	31.7 (19.6–42.4)	30.2 (23.0–43.4)	31.3 (17.7–44.4)	26 (25.2–26.9)	32.4 (19.0–42.6)
Gestational age (d)	283 (263–292)	278 (238–303)	277 (260–291)	278 (245–294)	277 (263–289)	278 (247–293)	281.5 (281–282)	279 (250–293)
Multiparous (%)	37.3[a]	59.1	25.0	42.5	77.8	67.9	50	61.1
Birth weight (g)	3640 (2870–4750)	3370 (1230–5140)	3435 (2840–3690)	3410 (2110–4530)	3550 (3210–3900)	3420 (1920–4630)	3835 (3580–4090)	3420 (2570–4430)
Head Circumference (cm)	35 (33–37.5)	34.5 (27–40.5)	34.5 (34–35)	34.5 (30–37.5)	35 (33–36)	34.5 (30.5–43)	35 (34.5–35.5)	34.5 (31.5–38)

[a]P<0.05, χ^2 test. Data are expressed as median (minimum-maximum), n or % as indicated. AST=Anal sphincter tear.

Table 3 Odds ratios for the occurrence of ASTs.

	AST	
	OR (95% CI)	Adj. OR (95% CI)
Maternal age		
<35 years	1	1
≥35 years	1.23 (0.71–2.15)	1.49 (0.84–2.65)
Parity		
1	1	1
>1	0.50 (0.31–0.82)[a]	0.39 (0.23–0.65)[a]
Birth weight		
<3500 g	1	1
≥3500 g	2.51 (1.52–4.14)[a]	2.89 (1.69–4.95)[a]
Head circumference		
<36 cm	1	1
≥36 cm	1.46 (0.84–2.55)	1.05 (0.58–1.90)
Gestational age		
<290 days	1	1
≥290 days	1.14 (0.45–2.84)	0.84 (0.33–2.12)
Birth position		
Bed	1	1
Squatting	2.92 (1.04–8.18)[a]	2.67 (0.95–7.53)
Kneeling	2.14 (1.05–4.37)[a]	2.21 (1.07–4.54)[a]
Water	0.86 (0.21–3.57)	0.83 (0.20–3.43)

[a]P<0.05. Data are expressed as unadjusted or adjusted Odds Ratio (95% Lower – 95% Upper Confidence Limit for OR), Adjustment for Maternal age, Parity, Birth weight, Head circumference, Gestational age, and Birth position. AST=Anal sphincter tear, OR=Odds ratio, CI=Confidence interval.

Discussion

Main findings

The overall incidence of AST was comparatively low (1.1%) due to the study design that excluded vaginal-operative deliveries and pressure on the uterine fundus. Significantly more ASTs occurred to women who gave birth in a squatting position (2.9%) and in a kneeling position (2.1%) compared with women who delivered on bed (1.0%) or in water (0.9%). Logistic regression analysis revealed a significantly higher risk for ASTs in a squatting position (OR 2.92) and in a kneeling position (OR 2.14) compared with the reference group on bed. When adjusting for risk factors (maternal age, parity, birth weight, head circumference, gestational age, and birth position), only birth in a kneeling position remained significantly associated with ASTs (adj. OR 2.21).

Strengths and limitations

An important strength of our study is the exclusion of births with external fundal pressure because this procedure may be a possible confounder for several reasons. Fundal pressure increases uterine pressure and shortens birth with a possibly increased risk for AST independently from the actual birth position. As described by Zetterström [18], this might be explained by the anatomy of the birth canal, which is slightly "J" shaped. The bottom of the "J" is formed by the rectum and perineum, and thus, the main part of the applied power is always directed toward this area. The strength of the external force is difficult to control. Furthermore, the most likely indication for fundal pressure is a non-reassuring cardiotocograph with imminent fetal asphyxia during the late second stage of birth. In this situation, the patient is commonly moved on the bed.

Our study protocol also draw strength from the large unicenter study population and the standardized course of action during a spontaneous vaginal birth throughout the study period. Support of the perineum during delivery has been obligatory. Postpartum perineal trauma was classified by obstetricians, and in case of AST, confirmed by senior physicians. Immediate electronic documentation was also performed throughout the whole study period.

A possible limitation of any retrospective study about maternal position during birth is that position is recorded at the time of birth only; thus, it is not possible to gain information on how long the patient has remained in this position.

Interpretation

There are several theories about the pathophysiological background for the occurrence of ASTs. Aside from the established risk factors mentioned above, we think that the most essential factor for the outcome of the pelvic floor and perineum is a combination of pushing force ("vertical force from above") and the midwife's/obstetrician's support of the perineum, and most of all, by slowing down the fetal head at the time of delivery ("counterforce from below"). In a squatting position, we believe that the parturient woman experiences a triggered stimulus to push hard in the final phase of birth. Furthermore, due to anatomic facts, a well-performed perineal support is more difficult to achieve. These facts result in an increased vertical force and a reduced counterforce. Our findings are congruent with the results of Gottvall [10] (squatting position with an adjusted OR of 2.1 for AST) and Jandér [13] (squatting position on a low birth chair with an OR of 6.5 for AST). A randomized, controlled trial of squatting in the second stage of labor has also reported increased rates of intact perineum in the squatting group compared with

women in a recumbent position; however, the study failed to specify or analyze the incidence of AST [9].

Our study is the first to show a significantly increased risk for ASTs during birth in a kneeling position. This elevated risk remained significant after adjustment for other putative confounders, such as parity, birth weight, maternal age, gestational age, and head circumference. A greater stimulus to push in a kneeling position may be possible, and the converse anatomical situation might be a relevant factor as well. As the midwife and obstetrician have to adapt their perineal management during birth to the reversed position, this may lead to confusion and insufficient perineal support.

To our knowledge, we are the first group to show that deliveries in water are not associated with an increased risk for ASTs as compared with deliveries on bed when excluding possible confounders. At the same time, the rate of episiotomies was significantly lower in water.

Our study population was distributed equally as regards important known risk factors for AST, such as fetal head circumference and birth weight. In the group who gave birth in a kneeling position, babies were statistically heavier compared with babies born on bed. However, the clinical relevance appears to be rather low at a median difference of only 60 g. Differences in maternal and gestational age at delivery were likewise small but statistically significant (Table 1), and no impact of these parameters on the occurrence of ASTs could be shown in the logistic regression analysis. There was a major difference regarding parity, with more primiparity in the squatting group and less in the kneeling group. However, when analyzing the characteristics of women with AST compared with controls within each group, the only significant difference was less multiparity with ASTs in the subgroup of birth on bed.

Previous studies have reported conflicting results about the effect of episiotomy on the occurrence of AST. It is generally accepted that midline episiotomies represent an independent risk factor [3]. In our study population of 5817 women, 61 midline episiotomies were performed. Given that no further perineal damage occurred in these patients, we did not include midline episiotomies in our multivariate analysis. Furthermore, a retrospective survey is not the right instrument to investigate the effect of an episiotomy on the occurrence of AST. This is because episiotomies in our hospital are performed only in case of fetal distress with a consecutive change of the actual maternal position or in the presence of anemic and tensed perineum, which represents a risk factor itself.

In our study population, only 2% of non-instrumental, vaginal deliveries occurred in an occipitoposterior or deflected position. Surprisingly, no AST occurred in this subpopulation, in contrast to the findings of other studies [7, 17]. In this context, it should be considered that occipitoposterior presentation is often associated with instrumental delivery, which is an important risk factor for the occurrence of ASTs itself, and that instrumental delivery was an exclusion criteria in our study. Shoulder dystocia occurred in 41 of 5817 deliveries (0.7%). Without any statistical association with the occurrence of ASTs observed, shoulder dystocia and occipitoposterior position were not further reviewed in our study.

Conclusion

Squatting position on a low birth stool and in a kneeling position are associated with a significantly increased incidence of ASTs; however, after adjustment for confounding factors, only the kneeling position remains significant. Birth in water is not associated with an increased risk for AST and results in less episiotomies. Given the high rate of anal incontinence 5 years after an AST [14], women should be informed before birth about the association of certain birth positions with the occurrence of AST. Due to the retrospective design of the study, our results have to be confirmed in a prospectively designed study.

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